

## Claims

I claim:

- 1 1. A method for fabricating a magnetic recording head comprising:  
2 providing a substrate;  
3 depositing a magnetically permeable thin film onto the substrate;  
4 defining a gap pattern;  
5 milling the gap pattern with a focused ion beam.
- 1 2. The method of claim 1, further comprising coupling the substrate to a coil which  
2 controllably causes magnetic flux to flow through the substrate and the thin film.
- 1 3. The method of claim 1, wherein providing a substrate further comprises:  
2 bonding two ferrite blocks to a ceramic member; and  
3 polishing an upper surface of the bonded blocks and ceramic member.
- 1 4. The method of claim 3, further comprising grinding the upper surface to produce a  
2 curvature, prior to polishing.
- 1 5. The method of claim 1, wherein depositing a thin film further includes sputtering a  
2 material onto the substrate to produce the thin film.
- 1 6. The method of claim 5 wherein the sputtered material has a high magnetic moment  
2 density.
- 1 7. The method of claim 5 wherein the sputtered material is chosen from the family of iron  
2 nitride alloys.
- 1 8. The method of claim 5 wherein the material is FeXN.
- 1 9. The method of claim 5 wherein the material is FeAlN.

- 1 10. The method of claim 5 wherein the material is FeTaN.
- 1 11. The method of claim 5 wherein the material is sputtered to form a thin film having a  
2 thickness between 1 to 5  $\mu\text{m}$ .
- 1 12. The method of claim 1 wherein the gap pattern defined is a timing based servo pattern.
- 1 13. The method of claim 1 wherein defining a gap pattern further includes providing a visual  
2 indication of the pattern on the thin film.
- 1 14. The method of claim 13 wherein the gap pattern defined is a timing based servo pattern.
- 1 15. The method of claim 13 wherein the visual indication is provided by:  
2 applying a layer of photoresist over at least a portion of the thin film;  
3 masking the photoresist; and  
4 removing a portion of the photoresist using known chemical processes.
- 1 16. The method of claim 15 wherein the gap pattern defined is a timing based servo pattern.
- 1 17. The method of claim 1 wherein defining a gap pattern further includes entering the  
2 numerical coordinates of the gap pattern into a control system of the focused ion beam.
- 1 18. The method of claim 17 wherein the gap pattern defined is a timing based servo pattern.
- 1 19. The method of claim 1 wherein the focused ion beam is substantially perpendicular to an  
2 upper major surface of the thin film during milling.
- 1 20. The method of claim 19 wherein the gap has nearly vertical side walls.
- 1 21. The method of claim 1 wherein the gap has nearly vertical side walls.

- 1 22. A magnetic recording head made by the method of claim 1.
- 1 23. A method of fabricating a magnetic recording head for timing based servo tracks  
2 comprising:  
3 providing a magnetically permeable substrate by glass bonding two ferrite blocks to a  
4 medially disposed ceramic member;  
5 sputtering a magnetically permeable thin film onto one surface of the substrate thereby  
6 providing a major surface;  
7 defining a timing based gap pattern;  
8 rastering a focused ion beam in a plane orthogonal to the plane of the major surface of the  
9 thin film, milling out the thin film in the defined gap pattern;  
10 coupling the substrate to a coil which controllably causes magnetic flux to flow through  
11 the substrate and the thin film.
- 1 24. The method of claim 23 wherein the thin film is FeXN.
- 1 25. The method of claim 23 wherein the thin film is FeAlN.
- 1 26. The method of claim 23 wherein the thin film is FeTaN.
- 1 27. The method of claim 23 wherein the gap pattern is defined by:  
2 depositing a layer of photoresist to at least a portion of the thin film;  
3 masking the photoresist;  
4 removing a portion of the photoresist using photolithography.
- 1 28. The method of claim 23 wherein the gap pattern is defined by providing a visual  
2 indication of the pattern on the thin film.
- 1 29. The method of claim 23 wherein the pattern is defined within a control system of the  
2 focused ion beam.

1 30 The method of claim 23 wherein the pattern is defined within the control system by  
2 entering the numerical coordinates of the gap to be milled.

1 31. The method of claim 23 wherein the gap has nearly vertical side walls.

1 32. A magnetic recording head made by the method of claim 23.